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EXECUTIVE SUMMARY

Problem

In recent years, medical providers and the scientific community have become increasingly aware that iatrogenic illness and injury are a major source of morbidity and mortality for hospitalized patients. However, little is known about the incidence, nature, and causes of adverse events in medical settings. Systematic knowledge of these events is the first step toward preventing them.

Objective

The objective of this project was to develop a survey that could be used to assess adverse medical events in an Intensive Care Unit (ICU). The survey was designed to gather data about adverse medical events involving hospitalized patients so that factors associated with these events and possible root causes could be identified.

Approach

A method called the critical incident technique was used to design a computer-administered survey, the Computerized Critical Incident Technique (CCIT) survey. The survey was designed to obtain information from medical providers on adverse medical events and near misses in the ICU. A test version of the CCIT survey (CCIT-I) was installed in the ICU of a major military hospital. The survey was used for a 26-month period.

Results

Data collection with the CCIT-I survey generated 482 incident reports. The survey system was positively received by the staff and the reports resulted in a number of corrective actions being taken. However, examination of the survey and of the data collected with the survey revealed several problems. These problems were due primarily to the survey's heavy reliance on closed-ended questions and to the survey's branching structure, which precluded comparability of data across respondents. Because of these problems, a major revision of the survey was performed.

The second version of the survey (CCIT-II) was evaluated by eight subject matter experts to determine users' reactions and to detect problems with the survey. In general, the subject matter experts had mostly positive comments and feedback. They provided suggested changes which were incorporated into the next revision of the survey. This resulted in the third, current version of the survey (CCIT-III), which is presented in the Appendix.

Conclusions

The potential for obtaining valuable information about adverse medical events using the CCIT-III survey appears promising. We recommend that the CCIT-III survey or a similar survey be used in health care settings so that recurring iatrogenic incidents can be identified and steps can be taken to prevent them.

ABSTRACT

Iatrogenic illness and injury are a major source of morbidity and mortality for hospitalized patients. However, little is known about the incidence, nature, and causes of adverse medical events. The objective of this project was to develop a survey that could be used to assess adverse medical events in an Intensive Care Unit (ICU). The survey was designed to obtain systematic information about adverse medical events so that factors associated with these events and root causes might be identified. The critical incident technique was used to develop the Computerized Critical Incident Technique (CCIT) survey. A test version of the survey (CCIT-I) was installed in the ICU of a major military hospital. Data collection with the survey generated 482 incident reports. The survey system was positively received by the staff and the reports resulted in a number of corrective actions. A revision of the survey was undertaken to correct several problem. The second version of the survey (CCIT-II) was evaluated by eight subject matter experts. The comments and suggestions provided by the subject matter experts were used as the basis for a second revision of the survey. This resulted in the third, current version of the survey (CCIT-III). The potential for obtaining valuable information about adverse medical events using a survey tool like the CCIT survey appears promising.

INTRODUCTION

Human error occurs in all aspects of life, including medical settings. In medical settings, however, the consequences of error can be particularly serious, resulting in the injury or death of patients. In recent years, medical providers and the scientific community have become increasingly aware that iatrogenic injury and illness are a major source of morbidity and mortality for hospitalized patients.

Adverse Events in Medical Settings

Iatrogenics literally means "doctor-caused." Iatrogenic injuries and illnesses are adverse effects related to the rendering of medical care, which are not a direct or indirect complication of the patient's primary condition or disease (Perper, 1994, p. 28). A number of somewhat confusing terms are currently used in the literature to designate iatrogenic events. These terms include adverse events, medical mishaps, critical incidents, medical accidents, care-related complications, therapeutic misadventures, iatrogenic misadventures, and nosocomial diseases (Perper, 1994, p. 28).

Little is known about the incidence, nature, and causes of adverse events in medical settings. Despite the importance of this topic, only a relatively small number of studies have examined adverse medical events in a systematic way (Abramson, Wald, Grenvik, Robinson, & Snyder, 1980; Bigby et al., 1987; Dubois & Brook, 1988; Gopher et al., 1989; Leape et al., 1991; Wright, Mackenzie, Buchan, Cairns, & Price, 1991). As recently as 1994, Van Cott (1994) stated that good data on the nature and extent of errors in clinical care do not exist. The most extensive and well known of the published studies is the Harvard Medical Practice Study. This study found that almost 4% of all patients hospitalized in New York state suffered an adverse event resulting in prolongation of

hospital stay or disability at time of discharge (Brennan et al., 1991; Dubois & Brook, 1988; Leape et al., 1991). Of these adverse events, more than two-thirds were considered preventable. Based on this study, it has been estimated that over a million patients are injured annually in hospitals in the U. S. by medical treatments intended to help them (Leape, 1994). Adverse medical events actually account for more deaths than all other types of accidents combined (Institute of Medicine, 1985).

Adverse events are particularly likely to occur in the more dynamic medical domains such as emergency rooms, operating rooms and intensive care units, which deal with complex, high-risk, acute patient care. The combination of intense and conflicting time demands, the dynamic nature of the environment, and the seriousness of the medical conditions encountered in these units increases the risk for iatrogenic events (Bogner, 1994a; Gaba, 1994).

Categories of Adverse Events

Adverse events that occur in medical settings have been categorized in many different ways in the research literature. Typically, adverse medical events are discussed in terms of what was done wrong or the type of error that was made (e.g., wrong medication, wrong diagnosis). Some of the more common categories of adverse events include those related to diagnosis, communication, equipment failure, medication errors, and procedures. Diagnosis-related events include errors in diagnoses, failure to employ the appropriate diagnostic tests, and failure to act appropriately based on the test results. Communication-related events include failure of staff in charge of a patient to convey crucial information to each other, failure to obtain information from a patient or from a patient's chart, and misinterpretation of written orders (e.g., due to illegible handwriting).

Equipment failure includes true equipment malfunction as well as user failure, which may be caused by a wide range of factors, such as unfamiliarity with the equipment and poor equipment design. Medication errors include failure to administer an ordered medication, administering the wrong medication, and administering the wrong dose of a medication. Problems related to procedures include use of inappropriate procedures and substandard performance of procedures.

Current Perspective on Human Error

In the past, efforts to reduce mishaps in medical environments and other settings (e.g., aviation, nuclear plants) have focused on identifying the individual or individuals who made the error or caused the mishap. However, this has not been an effective method for improving quality of care (Bogner, 1994b). Recently, the trend in human error research has been a more general, systems approach to the study of mishaps (Bogner, 1994a, 1994b; Gaba, 1994). In this approach, errors are viewed as evidence of systems failures, rather than the fault of individuals. Analysis of errors or mishaps is intended to uncover "root causes", which are often embedded in the overall system or organization. As pointed out by Leape (1994), human error may seem to be the cause of a patient inadvertently getting one drug instead of another, but the fact that the labels or containers are nearly identical is a systems fault that is easy to correct. Most experts in human error (e.g., Bogner, 1994a; Cook & Woods, 1994) now believe that a comprehensive approach to the assessment of mishaps requires an examination of the broader organizational context in which mishaps occur.

Research on adverse medical events has taken a variety of approaches, including patient chart reviews (Dubois & Brook, 1988; Leape et al., 1991), the use of incident

report forms (Abramson et al., 1980; Brennan et al., 1991; Gopher et al., 1989), questionnaires (Wright et al., 1991), and interviews (Bigby et al., 1987; Cooper, Newbower & Kitz, 1984). Each approach has various strengths and weaknesses associated with it.

Critical Incident Approach

One approach that is useful for studying adverse medical events is Flanagan's (1954) critical incident technique. The critical incident technique is a flexible set of procedures for gathering information about behavior in specific, real-life situations (Flanagan, 1954). First developed in the second World War by Flanagan, it is a systematic, open-ended procedure for eliciting information from respondents about specific incidents that they observed. The critical incident technique has been used in hundreds of studies in a wide range of domains, ranging from education to medicine. One of the main strengths of the technique is that it capitalizes on people's ability and willingness to tell stories or anecdotes about their experiences, yet it allows this information to be gathered in a structured, systematic way. Cooper et al. (1994) used the critical incident technique to study medical mishaps; other researchers (Bradley, 1992a; 1992b; Norman, Redfern, Tomalin, & Oliver, 1992) have used this technique for studying other aspects of patient care.

Most critical incident technique researchers (e.g., Flanagan, 1954; Norman et al., 1992) view a critical incident as a complete and clearly demarcated scene observed first-hand by a respondent. Flanagan defined an incident as "any observable human activity that is sufficiently complete in itself to permit inferences and predictions to be made about the person performing the act" (Flanagan, 1954, p. 326). Incidents are deemed

critical when the purpose of the action and the outcome of the incident are reasonably clear to the respondent or observer and are clearly relevant to the phenomenon under study (Flanagan, 1954). ("Critical" refers to an incident's relevance to the outcome and not to the severity of its effect.) For an incident to be usable for research purposes, the respondent or observer must have a detailed knowledge of both the incident and its context.

In the critical incident technique, critical incidents are obtained through interviews or questionnaires with individuals who are active in the domain under consideration (e.g., medicine or aviation). Most of the questions are open-ended, an important feature of the technique because it yields descriptions of incidents and their possible causes that are richer, more detailed, and more comprehensive than information obtained from closed-ended questions. After incidents have been collected, they can be examined post-hoc by judges who categorize the incidents and try to identify causes (Bradley, 1992b; Flanagan, 1954).

An important benefit of the critical incident technique is that it allows near misses to be studied, along with actual adverse events. Inclusion of near misses is important because it allows data on a larger set of incidents and causal variables to be obtained. Research on errors in aviation suggests that the study of near misses can give valuable clues to systems problems and other factors that might eventually lead to accidents.

Quality Assurance

Both the Department of Defense and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO, 1996) require that hospitals and ambulatory care facilities have quality assurance programs. The JCAHO (1996) sets forth performance

improvement standards that hospitals and other health care facilities should strive to achieve. For example, hospitals are required to establish guidelines for quality assurance and risk management and to maintain records that provide information on the quality of patient care. Although hospitals have to collect information internally on adverse events, they are not required by the JCAHO to report adverse medical events in any standardized way or to maintain standardized data bases on adverse events. Most hospitals use one or more of the following techniques to gather quality assurance data: incident reports, anonymous questionnaires, case reviews, patient chart reviews, administrative data, and observation. There are a host of problems with these methods, including biased reporting, incompleteness of information, failure to report all adverse incidents, and the lack of comparability of measurement across patients and departments. Clearly, health care facilities need more standardized, objective, and comprehensive methods for assessing adverse events and identifying their causes.

Objective

The objective of the present project was to develop a survey for assessing adverse medical events using the critical incident technique. The purpose of the survey was to allow the collection of information from hospital personnel on critical incidents (adverse events and near misses) occurring in an Intensive Care Unit (ICU). The ultimate goal was to use the data to make changes to reduce adverse events and improve patient care.

DEVELOPMENT OF THE CCIT SURVEY

An adaptation of the critical incident technique was used to design a computer-administered questionnaire, the CCIT (Computerized Critical Incident Technique) survey, for collecting information about adverse medical events. The survey also collected

information about other aspects of the medical work environment that might have an impact on patient care.

The first version of the CCIT survey (CCIT-I), which is described below, was developed and tested by Kobus, Amundson, Gubler, Rascona, Pang, and Van Orden (1996). Additional information about this version of the survey is provided in Kobus et al. (1996). The subsequent versions of the survey were developed by the present authors (Booth-Kewley and Freeman).

Description of the CCIT-I Survey

The CCIT-I survey elicited information about: (1) adverse events - incidents involving patient discomfort or morbidity outside the primary disease process, (2) near-misses - incidents that did not lead to an adverse event, (3) positive events - nonstandard actions by health providers that had a positive impact on the patient, and (4) workplace concerns - any issue or concern regarding the workplace environment.

The "core" of the survey consisted of questions asking respondents to describe actual medical mishaps (adverse events and near misses) they had participated in or observed recently in the ICU. After describing an incident, the respondent was asked to categorize the incident according to what the respondent believed to be the primary causal factor (e.g., equipment, communications, procedures). The follow-on questions differed at this point depending upon the category selected by the respondent. For example, a respondent who thought his/her incident belonged in the equipment category was asked detailed questions about the type of equipment involved, whereas a respondent who classified an incident as involving procedures was asked questions related to procedure type and performance. Questions were also asked about primary and secondary causes of

the incident, the immediate and secondary consequences to the patient, whether the incident was preventable, and what could be done to avoid such incidents in the future. This information was collected so that problems could be identified and quantified, possible causal factors could be identified, and interventions designed.

The first version of the CCIT survey (CCIT-I) was constructed in a computer-administered mode to make it easier and more interesting for respondents to complete and eliminate the need for data entry, thereby expediting feedback to the providers. The computerized mode of administration prevents missing data and branching errors which frequently occur on paper surveys (Rosenfeld, Booth-Kewley, & Edwards, 1993). The survey was administered on a Macintosh computer, in an easy-to-use format. Respondents were prompted with complete instructions on each screen and did not have to have computer experience to use the system.

Data Collection with the CCIT-I Survey

The CCIT-I survey was installed in the ICU at San Diego's Naval Medical Center (Balboa Hospital). It was used for a 26-month period. Staff members (e.g., nurses, physicians, corpsmen) were encouraged to complete surveys for any incident they had participated in or observed. Surveys were completed anonymously; no identifying information was obtained from respondents.

Using the CCIT-I survey, 482 cases were reported by medical staff at the San Diego Naval Medical Center's ICU. These cases included 149 adverse events, 157 near miss incidents, 157 workplace concerns, and 19 positive events. Since the survey was anonymous, and because some respondents completed multiple surveys, we cannot determine the total number of individuals who responded. The survey system was

positively received by the staff, and the reports resulted in a number of corrective actions taken to reduce the likelihood of future adverse events.

Problems with the CCIT-I Survey

An examination of the first version of the CCIT survey (CCIT-I) and the data identified several problems. A major defect was the fact that the survey forced the respondent to classify each adverse event or near miss incident into a single discrete category early on in the survey. As a result, many instances of seemingly similar incidents were categorized differently by different respondents. For example, a fairly large portion of the adverse events and near misses involved problems with the insertion of a line or tube. This problem was classified by some users as a "procedure" problem, by some as a "medication" problem, and by others as an "equipment" problem. Examination of the narrative information failed to reveal systematic reasons for these differences in categorization. It appeared that, in the absence of stated criteria for categorizing events, respondents classified events arbitrarily or according to their own subjective criteria.

The classification inconsistencies noted above produced an additional problem. The CCIT-I survey was designed so that the initial problem category chosen by the user determined (via branching) the set of questions the user was subsequently asked. As a result, different sets of follow-on questions were presented to respondents, depending upon their initial choice of category (e.g., procedure, equipment). This meant that the data collected from one respondent could be very different from the data collected from another respondent even when the incidents (e.g., intubation problems) were similar. Consequently, a standardized set of data was not collected, the data could not be systematically tabulated, and data were not comparable across respondents.

First Revision of the Survey - CCIT-II

Because of the problems detected in the first version of the CCIT survey, the survey was revised. The second version of the survey (CCIT-II) was designed to collect a more complete and accurate description of incidents and produce more standardized data. Instead of having respondents initially place their critical incidents into discrete categories (as in the test version), the CCIT-II survey asked users to describe incidents in an open-ended fashion. This approach more closely resembles the original critical incident method described by Flanagan (1954). It also avoids the problem of different respondents placing seemingly similar incidents into different categories. In keeping with Flanagan's method, the CCIT-II survey was designed to focus respondents' efforts on describing the events in detail, with the idea that judges could be used post-hoc to examine the data and categorize the incidents and possible causes. In CCIT-II, respondents spent less time categorizing events in a highly structured menu scheme, and more time describing the incidents with open-ended text boxes. In the CCIT-II survey, most of the questions were posed to all respondents, thus ensuring comparability of data across respondents.

In the CCIT-II survey, definitions of key terms were presented to users in the introductory portion of the survey. A critical incident was defined as "an event that did cause or could have caused an injury or other negative outcome to a patient as a result of medical care." It was indicated that "a critical incident can either be an adverse event, in which there was an negative consequence for the patient, or a near miss, in which there could have been a negative consequence but the problem was detected and fixed in time." Negative consequences experienced by patients could include the following: discomfort,

stress, increased hospital stay, increased severity of the illness, a need for more treatment, development of a new condition, disability or death. These expanded definitions of "adverse event" and "near miss" were added to the CCIT-II survey because examination of CCIT-I survey data suggested that some respondents had failed to understand the meaning of these key terms. Also, the category called "positive events" was dropped from the CCIT survey because only a small number of positive events were reported with the CCIT-I survey, and because the events that were reported did not seem relevant to the prevention of iatrogenic illness and injury.

In the first version of the CCIT survey, there was no way to determine how many different respondents had reported critical incidents. Because it is possible that a small number of respondents were responsible for the bulk of the incident reports, it was decided that the revised CCIT survey should have a method for determining how many reports were from the same respondent. Therefore, we had respondents generate their own identification (ID) numbers, which they were to type in each time they completed a survey. The self-generated ID would be unknown to anyone other than the respondent. It consisted of 8 digits: 4 digits representing the respondent's mother's birthday, 2 digits indicating the number of people in the respondent's immediate family when s/he was age 10, and 2 digits indicating the respondent's age when s/he first owned a car (see Appendix A for more detail). The purpose of the self-generated ID was to allow incident reports to be linked or tallied for a single respondent, and to allow a determination of sample size.

One final change from the first to the second version of the CCIT survey was to convert it from a Macintosh to a PC DOS-based format. The DOS version of the Ci3

System for Computer Interviewing by Sawtooth Technologies (Sawtooth Software, 1994) was used to program and administer the survey. Since DOS-based systems are commonplace in military and civilian hospital environments, this conversion was performed to increase survey availability and allow greater expansion and modification of the CCIT survey for use in other institutions.

Evaluation of the CCIT-II Survey by Subject Matter Experts

The revised version of the survey (CCIT-II) was evaluated by subject matter experts (SMEs) to obtain users' reactions to the survey, assess content validity, and detect problems. Eight emergency medical responders served as the SMEs (7 males and 1 female). SMEs were instructed to complete several CCIT-II surveys each, using critical incidents and workplace concerns drawn from their own professional experiences. They were given a hand-out that listed the questions they would be asked in the post-evaluation interview. They were asked to make notes while completing the survey of their impressions and any problems that they noticed.

After evaluating the survey (which they could do over a one to two week time period), each SME was interviewed individually by one of the researchers. The interviews lasted approximately 30 minutes. In the interviews, SMEs were first asked about their overall impressions of the survey (positive or negative). Subsequent questions addressed specific aspects of survey presentation and content. They were asked, for example, how easy or difficult they found it to complete the survey and their opinion of the computer-administered format. They were asked if they had suggestions for changing individual survey questions (i.e., could some of the questions be reworded to make them easier to answer? How?). They were asked if they thought the survey was too long

and/or time-consuming; if the survey was comprehensive enough; whether the instructions were clear; whether the definitions of key terms (e.g., adverse event) were clear; whether the survey questions seemed redundant; and whether the medical terminology was appropriate. The SMEs were also asked if potential survey users completing the survey in their own workplace might feel uncomfortable recording real life incidents. Finally, they were asked if they thought that use of such a survey by health care facilities would improve risk management and quality of care.

Results of Subject Matter Experts Evaluations

In general, the subject matter experts had mostly positive comments and feedback about the survey. To summarize, six of the eight SMEs indicated without qualification that they liked the survey and all eight believed its adoption by clinical care facilities could greatly improve risk management and quality of care. Moreover, all of the SMEs liked the computer format and thought it was easier, more enjoyable and more practical to use than a paper-and-pencil survey. While none of the SMEs felt the survey was too long, nearly all of the experts thought the survey was sufficiently comprehensive.

Some of the SMEs recommended giving survey users more introductory information on the purpose of the survey, how their answers would be evaluated, to whom the data would be shown, and what actions their organization would take after receiving the results. In addition, three of the SMEs expressed concerns relating to respondent anonymity: they asked us to give users more assurance that their anonymity would be protected and that their data would not be traced back or linked to them. Two of the SMEs believed that the most sensitive questions, or the questions most likely to jeopardize anonymity ("Who discovered the problem?" and "What was your role in the

incident?") should be made optional. Three of the SMEs believed that the demographic items should be made optional or removed; one recommended that we explain the purpose of the demographic items (e.g., for research purposes only). Two of the SMEs recommended that we explain the purpose of the self-generated ID number (e.g., for research purposes only).

The SMEs identified several ambiguous phrases in the survey that needed to be clarified and made recommendations to improve the wording of some survey questions. They also identified multiple-choice questions that needed more options to cover all of the possible responses. A number of the SMEs noted that some of the open-ended text boxes did not allow enough space for the amount of narrative they wanted to write. Several of them said they had found it difficult to answer the questions that used 7-point Likert scales because of the large number of scale points and also because a "Don't Know" option was not offered. Three of the SMEs identified questions that were highly redundant and suggested that we eliminate some of these questions. Finally, three of the SMEs stressed the potential value of the Workplace Concerns section and suggested it be expanded to elicit more detailed information on workplace concerns.

Second Revision of the Survey - CCIT-III

Based on the feedback from the SMEs, the CCIT survey was revised. Because the SMEs did not have a large number of major criticisms, the changes made from the second to the third version of the survey were relatively minor. Sawtooth Software's Ci3 System for Computer Interviewing was retained as the software for design and administration of the survey. The final version of the survey, which incorporates these changes, is presented in Appendix A.

The following changes were made to the CCIT survey. In the introductory portion of the survey, statements were added to assure respondents that their anonymity would be preserved and that no one in the health care facility would have access to their individual data or would be able to trace their data to them. Some of the more specific demographic items were eliminated and respondents were given an option to skip all of the demographic questions. A statement about the purpose of the demographic questions was added: "This information is for statistical purposes only. It will not be used to identify you".

A number of other changes were also made to the survey. An explanation of the need for the self-generated ID number was added. The Likert scales were changed from 7-point to 4-point scales to make it easier for respondents to answer, and a "Don't Know" option was added. Some of the questions identified as redundant by the SMEs were eliminated from the survey. For some questions (those noted by the SMEs to have insufficient space), additional space was added to the open-ended text boxes. Several questions were reworded in accordance with the SMEs recommendations to improve item clarity. Instructions were also added on how to report an incident involving a mistake that did not lead to a negative outcome for a patient. Finally, the Workplace Concerns section of the survey was expanded to allow more detailed information about the concern to be gathered.

DISCUSSION

It is widely recognized that iatrogenic illness and injury are a major source of morbidity and mortality for hospitalized patients. The first step towards preventing adverse medical events is to determine the types of adverse events that occur most often

and the factors that lead up to them. Detailed knowledge of adverse events that occur in real-life clinical settings and their underlying causes may lead to changes that could substantially improve patient care.

In the present project, the CCIT survey was developed to systematically collect information about adverse medical events. The survey was developed using Flanagan's (1954) critical incident technique, and was computer-administered. The test version of the CCIT survey (CCIT-I) collected incident reports over a 26-month period in the ICU of a large military hospital. The survey was positively received by staff and the incident reports obtained from the survey led to a number of corrective actions being taken. However, a careful examination of the CCIT-I survey revealed several significant problems. These problems included classification problems, lack of comparability in data collected across respondents, and closed-ended questions that did not elicit enough detail about adverse events. Therefore, the survey was revised to correct these deficiencies. The second version of the CCIT survey (CCIT-II) was evaluated by subject matter experts (SMEs), who gave comments and recommendations about how the survey could be improved. These comments and recommendations were used to revise the survey again, resulting in an improved, "final" version of the CCIT survey (CCIT-III), which appears in Appendix A.

The subject matter experts who evaluated the CCIT survey had mostly positive comments about it. They liked the computer-administered format, did not think the survey was too long, and thought it was comprehensive. The SMEs had a number of suggestions and recommendations for improving the survey and for clarifying some specific questions. Interestingly, all of the SMEs believed that it would be worthwhile for

the CCIT survey or a similar survey to be implemented by health care facilities to improve risk management and patient care.

Several of the SMEs suggested that when this survey is implemented in a work environment, the following questions should be answered for potential respondents: (1) What is the purpose of the survey (research, risk management, etc.)?; (2) What will be done with the information obtained via the survey--will it be used to make changes?; (3) What kind of feedback, if any, will users receive after the results are compiled?; (4) How will the data be made available to the organization--i.e., will the hospital ever have access to the raw data or only summary results?; (5) Can anonymity of responses be absolutely guaranteed? and (6) Does this survey replace the existing incident reporting system? The SMEs were enthusiastic about the survey, yet they believed that these points should be fully addressed.

As noted above, a number of the SMEs expressed concerns about respondent anonymity. They strongly believed that some medical care providers might be hesitant to describe incidents that could establish culpability. Because anonymity is so important, the most recent version of the CCIT survey asks only a few demographic questions and allows respondents to skip some or even all of these questions. For the same reason, the survey does not require respondents to give detailed information (e.g., date, time) on the incident. Feedback from the SMEs clearly demonstrated that if accurate data are to be gathered, maintaining respondents' anonymity is of paramount importance in the CCIT.

The CCIT survey differs from existing quality assurance systems that hospitals have because: (1) it is completely anonymous; (2) it requires no paperwork and (3) it is primarily a research tool. In contrast, hospital quality assurance systems may or may not

be anonymous, require a substantial amount of paperwork, and are not conducted for research purposes. If implemented in hospitals or other health care settings, the CCIT survey would augment but not replace existing quality assurance systems.

An important strength of the CCIT survey is its inclusion of near misses. Most research on medical mishaps has focused on adverse events only; near misses have rarely been studied. Based on research from aviation and other industries, there seems to be considerable value in the study of near misses (Perrow, 1984). Inclusion of near misses allows information on a larger and broader set of incidents to be gathered and allows root causes to be detected fairly early in the chain of accident evolution.

Another strength of the CCIT survey is its assessment of workplace concerns, along with near misses and adverse events. In the present study, a workplace concern was defined as "any issue or concern regarding the workplace environment." Most of the workplace concerns expressed by survey respondents were concerns about other workers not doing their jobs properly, problems with supervisors, supply problems, environmental problems (e.g., poor lighting), and problems with hospital procedures. Because each of these factors could potentially play a role in activating or sustaining the chain of events leading up to an adverse event, it is important that they be identified, studied, and understood.

The potential for obtaining valuable information about adverse medical events using a survey tool such as the CCIT survey appears promising. Based on our experience, a much greater quality and quantity of incident data can be expected using this approach than could be obtained via review of medical charts or legally required hospital incident report forms. This conclusion was also expressed by some of the SMEs who evaluated

the CCIT survey. We recommend that the CCIT or a similar survey be used in clinical care settings. Such a survey could be implemented in the Department of Defense's existing bedside clinical integrated work stations. Integration into existing systems would make it easy for health care professionals to record near misses and adverse events as they occur.

For health care facilities to successfully implement this survey approach, several thorny issues will have to be addressed. First, users of the CCIT survey must be prepared to have one or more experts interpret and follow up on critical incidents assessed by the survey; the CCIT survey will not automatically summarize the data. In addition, implementation of a survey like the CCIT will cause facility administrators to have to grapple with questions of anonymity and respondent liability, medico-legal implications, and workplace morale. Finally, a commitment from all levels of management regarding the importance of the survey is necessary to ensure adequate participation of health care personnel and to protect these personnel from negative repercussions as a result of disclosing adverse events.

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Appendix A

Computerized Critical Incident Technique Survey

1

WELCOME TO THE COMPUTERIZED CRITICAL INCIDENT TECHNIQUE (CCIT) SURVEY

This survey system has two purposes:

It allows you to report "critical incidents" involving hospitalized patients.

It allows you to report workplace concerns.

TO EXIT COMPLETELY, press Ctrl-End. If you want to exit at some point later in the survey, try pressing Ctrl-End twice.

Press any key to continue.

2

You may choose to use the system for ONE or for BOTH of these purposes (critical incidents or workplace concerns).

Both reports go into a centralized data base which will be used to detect problems and make positive changes in health care and in the working environment.

Press any key to continue.

3

A CRITICAL INCIDENT is an event that did cause or could have caused an injury or other negative outcome to a patient as a result of medical care. Such an incident involves actual or potential harm to a patient as a result of medical treatment or care s/he received or failed to receive.

Another term for a critical incident occurring in a medical setting is medical mishap.

Press any key to continue.

4

A critical incident can either be an ADVERSE EVENT, in which there was a negative consequence for the patient or a NEAR MISS, in which there could have been a negative consequence but the problem was detected and fixed in time.

Negative consequences experienced by patients might include discomfort or stress for the patient, increased hospital stay, increased severity of illness, a need for additional treatment, development of a new condition, disability, or death.

Press any key to continue.

5

The KEY FOCUS of this project is critical incidents occurring in intensive care units (ICUs). However, for this preliminary version of the survey, we will accept incidents that happened in intensive care, critical care, operating rooms, or emergency rooms.

Press any key to continue.

6

Before reporting a Critical Incident ask yourself:

Did I personally participate in OR observe the incident first-hand?

Do I remember the incident well enough to describe it in detail?

If you answered "YES" to these questions, we want you to report the incident.

If not, you may think of another incident that meets these criteria or report a workplace concern.

Press any key to continue.

7

The OTHER FOCUS of this survey system is workplace concerns.

A WORKPLACE CONCERN is any other issue or concern regarding people in the workplace or the workplace environment.

A WORKPLACE CONCERN is generally an ongoing problem in the workplace. It might have to do with policies or procedures, working conditions, communication, equipment, supplies, inadequate functioning of a hospital service, or problem staff members.

Press any key to continue.

8

If you have any workplace concerns occurring in either intensive care, critical care, the operating room or emergency, you can report them using this system.

Press any key to continue.

9

Be assured that no one in this or any other health care facility will have access to the information that you enter into this survey system. Only summary results (grouped across survey respondents) will ever be reported. No one in your organization will ever be able to link the information that you report back to you as an individual.

Press any key to continue.

10

Do you want to enter either a critical incident or a workplace concern?

Press Y for YES to continue or N for No to Exit the system.

11

In order to link multiple workplace concerns and critical incident reports from the same person, you are asked to generate an ID number.

This ID cannot be used to identify you--it is for research purposes only. Its purpose is to link your data if you complete more than one report using this system (e.g., to tally up number of reports and number of reports per respondent).

Press any key to continue.

12

The ID will consist of the following, in the order shown:

--a 4-digit number indicating your mother's birthday (2 digits for MONTH, 2 digits for DAY). March 20 would be "0320".

--a 2-digit number indicating the number of people who were in your immediate family (including you) when you were age 10. If your family was made up of you plus 3 other members, you would type "04" (be sure to include the zero).

--your age when you first owned a car. Type 00 if you have never owned one. If you first owned a car at age 19, you would type "19".

In the above example, the ID would be 03200419.

Type these 8 characters in the space below and press ENTER.

If you make a mistake, use the BACKSPACE key and retype.

13

If you have already completed this survey at least once, you may wish to skip the next few introductory screens.

Do you want to go directly to the screen that lets you choose a critical incident versus a workplace concern?

Press Y for YES or N for No.

14

You may use the system as often as you wish. However, please do not report the same CRITICAL INCIDENT more than once unless the incident happened more than once.

Press any key to continue.

15

You will be answering questions by following the instructions that appear on each screen.

If you want to go back and review an answer to a previous question or look at a previous screen, press the "ESC" key (usually in the upper left-hand side of the keyboard). ESC allows you to backtrack within the survey. To retain a previous answer after backtracking, simply press ENTER--this will move you forward in the survey. To change a previous answer, type in the new answer and it will replace your old one.

Press any key to continue.

16

When typing answers to the survey questions, mixing upper- and lower-case letters is okay.

You can move around the text you've typed and edit by using the arrow keys.

Press any key to continue.

17

If you wish to make both types of reports (critical incident and workplace concern), simply pick EITHER critical incident or workplace concern from the menu that follows and complete the report.

When you have completed the report, you will be returned to the main menu. At that point, simply pick the OTHER type of report.

Press any key to continue.

18

What type of report do you wish to make?

1. Critical Incident
2. Workplace Concern
3. None-Please exit me from the system

Press 1, 2, or 3.

CRITICAL INCIDENT SECTION

19

A CRITICAL INCIDENT is a specific event involving a patient that had or could have had a negative impact on the patient.

Some critical incidents are due to poor patient care but many occur despite good care (e.g., an unexpected drug reaction).

Press any key to continue.

20

A critical incident can be the result of something that was DONE to a patient or due to something that was NOT DONE (e.g., failure to monitor a patient).

Examples of critical incidents include medication errors, problems with equipment or supplies, communication problems, problems with medical procedures, problems with hospital services (e.g., lab), and problems with staff members' performance.

Press any key to continue.

21

If the incident you have in mind involved a mistake or deviation from accepted standards of care but it did not lead to a negative outcome for a patient, you may choose to report it either as a critical incident (near miss) or as a workplace concern.

Report it as a critical incident if you think it is likely that this type of mistake could ever be clinically significant and lead to a negative outcome for a patient. Report it as a workplace concern if you think it is unlikely that this type of mistake could ever lead to a negative outcome for a patient.

Press 1 to go to the section on Workplace Concerns.
Press 2 to continue the Critical Incident section of the survey.

22

We want you to report the most recent critical incidents you can recall.

If you are trying to decide which of 2 or 3 different incidents to report, please report the one that occurred MOST RECENTLY.

You are welcome to report all incidents that meet the criteria: (1) you personally participated or observed it, and (2) you remember it well enough to describe it in detail.

Do you have an incident in mind that you want to report?

Press Y for YES or N for No.

23

When answering the questions that follow, please define each abbreviation you use so that your answers will be clear to NONMEDICAL personnel.

When answering any open-ended question (essay-type), you can always type "Not Applicable" when appropriate. Also, if you have already answered the question being posed, please indicate this by typing "See Previous" or something similar. You do NOT need to specify the previous screen/question.

Thanks for your patience!

Press any key to continue.

24

What happened? Explain what happened from YOUR OWN PERSPECTIVE (e.g.,"I noticed that the patient was not given medication on time" . . .).

Explain WHO did WHAT using people's positions to refer to them rather than their names (e.g., "An MD made a ventilator change . . .").

Type your answer in the space below. When you reach the end of the line, keep typing (you don't need to press enter). When finished, press ENTER twice.

25

Who discovered the problem? (e.g., a nurse, a physician, etc.)

You can skip this question if you choose. Do you want to answer this question?

Press Y for YES to continue or N for No to skip this question.

26

Who discovered the problem? (e.g., a nurse, a physician, etc.)

Type your answer in the space below. When finished, press ENTER twice.

27

What was your role or position with regard to this incident/patient (e.g., "I was the patient's bedside nurse")?

You can skip this question if you choose. Do you want to answer this question?

Press Y for YES to continue or N for No to skip this question.

28

What was your role or position with regard to this incident/patient (e.g., "I was the patient's bedside nurse")?

Type your answer in the space below. When finished, press ENTER twice.

29

How many days ago (approximately) did the incident occur?

Type the number in the space below and press ENTER.

30

Do you think this event could have been avoided or prevented?

1. Definitely
2. Probably
3. Probably not
4. Definitely not
5. Don't know

Press a number between 1 and 5.

31

Explain why you think this event possibly could have been AVOIDED or PREVENTED.

Type your answer in the space below. When finished, press ENTER twice.

32

Explain why you think this event probably could NOT have been AVOIDED or PREVENTED.

Type your answer in the space below. When finished, press ENTER twice.

33

Please explain your answer if necessary--i.e., why aren't you sure if this event could have been AVOIDED or PREVENTED?

Type your answer in the space below. When finished, press ENTER twice.

34

What do you think was the most important cause of this incident?

Type your answer in the space below. When finished, press ENTER twice.

35

Describe any other factors which may have played a role in the incident.

If you cannot think of any others, type "None".

Type your answer in the space below. When finished, press ENTER twice.

36

What was the sex of the patient?

1. Male
2. Female
3. Don't Know

Press 1, 2 or 3.

37

What was the approximate age of the patient?

Type the number in the space below and press ENTER.

_____

38

What was the patient's condition before the incident?

1. Stable
2. Unstable
3. Stable but potentially unstable if not treated promptly
4. Comfort care
5. Don't know
6. Other

Press a number between 1 and 6.

39

What was/were the patient's main diagnosis/diagnoses before the critical incident?

Type your answer in the space below. When finished, press ENTER twice.

40

What were the NEGATIVE CONSEQUENCES of the incident for the patient? Some possible negative consequences include discomfort, increased morbidity, prolonged hospital or ICU stay, extra procedures required, disability, or death.

If there were no negative consequences, type "None".

Type your answer in the space below. When finished, press ENTER twice.

41

Would you say that the incident was an ADVERSE EVENT or a NEAR MISS?

In an ADVERSE EVENT, there is some negative consequence for the patient (which can include discomfort).

A NEAR MISS is a situation that could have led to a negative consequence for the patient but did not (either due to chance or because the problem or error was detected and fixed in time).

I would classify the incident as a(n):

1. Adverse Event
2. Near Miss
3. Other or Neither

Press 1, 2, or 3.

42

Do you think that the incident was life threatening?

1. Definitely
2. Probably
3. Probably not
4. Definitely not
5. Don't know

Press a number between 1 and 5.

43

Please give the positions of the personnel who were directly involved in the incident (e.g., 1 staff physician, 1 nurse, and 1 intern). Be as specific as possible. (Include YOURSELF if you were involved.)

Press ENTER twice when done.

44

How involved were you in the incident?

1. I was directly involved
2. I was NOT involved but I OBSERVED the incident
3. I was NOT involved, NOR did I observe the incident (I heard about it from someone else)
4. Other

Press a number between 1 and 4.

45

Do you think this event involved human error?

1. Definitely
2. Probably
3. Probably not

4. Definitely not
5. Don't know

Press a number between 1 and 5.

46

Explain why you think human error WAS or WAS NOT involved. (Type "see previous" if you already gave this information.)

Type your answer in the space below. When finished, press ENTER twice.

47

Do you think the incident involved ineffective performance by a staff member?

1. Definitely
2. Probably
3. Probably not
4. Definitely not
5. Don't know

Press a number between 1 and 5.

48

Did the incident involve a problem with MEDICATION (such as a medication error or a failure to medicate) or BLOOD/BLOOD PRODUCTS?

Press Y for YES or N for No.

48.1

What specific MEDICATION(S) or BLOOD/BLOOD PRODUCTS were involved?

Type your answer in the space below. When finished, press ENTER twice.

48.2

If a medication, what general category of MEDICATION(S) was involved? (such as antibiotics). If a medication was not involved, type "NA" for "Not Applicable".

Type your answer in the space below. When finished, press ENTER twice.

48.3

Do you have any other comments you wish to make about the MEDICATION(S) or BLOOD/BLOOD PRODUCTS involved in this incident?

Press Y for YES or N for No.

48.4

Type your additional comments in the space below. When finished, press ENTER twice.

49

Did the incident involve a problem with a PROCEDURE?

Press Y for YES or N for No.

49.1

Explain how this PROCEDURE caused a problem.

Type your answer in the space below. When finished, press ENTER twice.

49.2

What PROCEDURE was involved?

Type your answer in the space below. When finished, press ENTER twice.

49.3

Was the PROCEDURE appropriate?

1. Definitely
2. Probably
3. Probably not
4. Definitely not
5. Don't know
6. Not applicable

Press a number between 1 and 6.

49.4

Was the PROCEDURE done competently?

1. Definitely
2. Probably
3. Probably not
4. Definitely not
5. Don't know
6. Not applicable

Press a number between 1 and 6.

49.5

Should a PROCEDURE have been done that was not done?

Press Y for YES or N for No.

49.6

Do you have any other comments you wish to make about the PROCEDURE(S) involved in this incident?

Press Y for YES or N for No.

49.7

Type your additional comments in the space below. When finished, press ENTER twice.

50

Did the incident involve a problem with EQUIPMENT or SUPPLIES (or lack of equipment or supplies)?

Press Y for YES or N for No.

50.1

What specific EQUIPMENT or SUPPLIES were involved?

Type your answer in the space below. When finished, press ENTER twice.

50.2

Do you have any other comments you wish to make about the EQUIPMENT or SUPPLIES involved in this incident?

Press Y for YES or N for No.

50.3

Type your additional comments in the space below. When finished, press ENTER twice.

51

Did the incident involve inadequate functioning of a HOSPITAL SERVICE (e.g., lab, pharmacy, etc.)?

Press Y for YES or N for No.

51.1

What HOSPITAL SERVICE was involved?

Type your answer in the space below. When finished, press ENTER twice.

51.2

Do you have any other comments you wish to make about the HOSPITAL SERVICE involved in this incident?

Press Y for YES or N for No.

51.3

Type your additional comments in the space below. When finished, press ENTER twice.

52

Rate the importance of the factor shown below in causing the incident. Type in a number between 1 and 5 to show how IMPORTANT or UNIMPORTANT you think the factor was. You can type in a number that is between rating points, such as 3.5.

Type a zero (0) if you are UNSURE or DON'T KNOW.

After you have typed in a number, press ENTER.

Inadequate supervision of medical staff

0	1----------2----------3----------4----------5		
Don't Know	Not at all Important	Moderately Important	Extremely Important

53

Rate the importance of the factor shown below in causing the incident. Type in a number between 1 and 5 to show how IMPORTANT or UNIMPORTANT you think the factor was. You can type in a number that is between rating points, such as 3.5.

Type a zero (0) if you are UNSURE or DON'T KNOW.

After you have typed in a number, press ENTER.

Poor morale of medical staff

0	1----------2----------3----------4----------5		
Don't Know	Not at all Important	Moderately Important	Extremely Important

54

Rate the importance of the factor shown below in causing the incident. Type in a number between 1 and 7 to show how IMPORTANT or UNIMPORTANT you think the factor was. You can type in a number that is between rating points, such as 3.5.

Type a zero (0) if you are UNSURE or DON'T KNOW.

After you have typed in a number, press ENTER.

Lack of teamwork among medical staff

0	1----------2----------3----------4----------5		
Don't Know	Not at all Important	Moderately Important	Extremely Important

55

Rate the importance of the factor shown below in causing the incident. Type in a number between 1 and 7 to show how IMPORTANT or UNIMPORTANT you think the factor was. You can type in a number that is between rating points, such as 3.5.

Type a zero (0) if you are UNSURE or DON'T KNOW.

After you have typed in a number, press ENTER.

Shortage of equipment or supplies

0	1----------2----------3----------4----------5		
Don't Know	Not at all Important	Moderately Important	Extremely Important

56

Rate the importance of the factor shown below in causing the incident. Type in a number between 1 and 7 to show how IMPORTANT or UNIMPORTANT you think the factor was. You can type in a number that is between rating points, such as 3.5.

Type a zero (0) if you are UNSURE or DON'T KNOW.

After you have typed in a number, press ENTER.

Faulty equipment or supplies

0	1----------2----------3----------4----------5		
Don't Know	Not at all Important	Moderately Important	Extremely Important

57

Rate the importance of the factor shown below in causing the incident. Type in a number between 1 and 7 to show how IMPORTANT or UNIMPORTANT you think the factor was. You can type in a number that is between rating points, such as 3.5.

Type a zero (0) if you are UNSURE or DON'T KNOW.

After you have typed in a number, press ENTER.

Unit busy and/or understaffed

0	1----------2----------3----------4----------5		
Don't Know	Not at all Important	Moderately Important	Extremely Important

58

Rate the importance of the factor shown below in causing the incident. Type in a number between 1 and 7 to show how IMPORTANT or UNIMPORTANT you think the factor was. You can type in a number that is between rating points, such as 3.5.

Type a zero (0) if you are UNSURE or DON'T KNOW.

After you have typed in a number, press ENTER.

Patient's behavior or actions

0	1----------2----------3----------4----------5		
Don't Know	Not at all Important	Moderately Important	Extremely Important

59

Rate the importance of the factor shown below in causing the incident. Type in a number between 1 and 7 to show how IMPORTANT or UNIMPORTANT you think the factor was. You can type in a number that is between rating points, such as 3.5.

Type a zero (0) if you are UNSURE or DON'T KNOW.

After you have typed in a number, press ENTER.

Lack of conscientiousness on the part of medical staff

0	1----------2----------3----------4----------5		
Don't Know	Not at all Important	Moderately Important	Extremely Important

60

Rate the importance of the factor shown below in causing the incident. Type in a number between 1 and 7 to show how IMPORTANT or UNIMPORTANT you think the factor was. You can type in a number that is between rating points, such as 3.5.

Type a zero (0) if you are UNSURE or DON'T KNOW.

After you have typed in a number, press ENTER.

Lack of skill on the part of medical staff

0	1----------2----------3----------4----------5		
Don't Know	Not at all Important	Moderately Important	Extremely Important

61

Rate the importance of the factor shown below in causing the incident. Type in a number between 1 and 7 to show how IMPORTANT or UNIMPORTANT you think the factor was. You can type in a number that is between rating points, such as 3.5.

Type a zero (0) if you are UNSURE or DON'T KNOW.

After you have typed in a number, press ENTER.

Seriousness of the patient's condition

0	1----------2----------3----------4----------5		
Don't Know	Not at all Important	Moderately Important	Extremely Important

62

Do you have any OTHER suggestions on how events like the one you reported could be prevented in the future?

If so, type them below. Press ENTER twice when you are done.

If you do not have any suggestions, simply press ENTER twice.

63

Do you have any other comments about the incident?

If so, type them below. Press ENTER twice when you are done.

If you do not have any other comments, simply press ENTER twice.

WORK PLACE CONCERNS SECTION

64

A WORKPLACE CONCERN is any issue or concern regarding the workplace environment.

A WORKPLACE CONCERN is generally an ongoing problem in the workplace. It might have to do with policies or procedures, working conditions, communication, equipment, supplies, inadequate functioning of a hospital service, or problem staff.

Do you have an workplace concern in mind that you want to report?

Press Y for YES or N for No.

65

What was/is the problem? Describe the workplace concern in your own words.

Please describe ONE workplace concern only. (You can re-enter the system to describe additional workplace concerns.)

Type your answer in the space below. When you reach the end of the line, keep typing (you don't need to press enter). When finished, press ENTER twice.

66

Would you say that this an ongoing problem?

Press Y for YES or N for No.

67

How often would you say that this problem occurs?

1. Almost all the time (it is a chronic problem)
2. Daily
3. Weekly
4. Monthly
5. Less often than once a month
6. Don't know

Press a number between 1 and 6.

68

Where does/did this problem occur (e.g., ICU, ER, etc.)? If the problem typically occurs in more than one area, please indicate all of them.

Type your answer in the space below. When finished, press ENTER twice.

69

What do you think could be done to solve or minimize this problem? Explain in your own words.

Type your answer in the space below. When finished, press ENTER twice.

70

Has anything been done already in an attempt to solve this problem? What?

Type your answer in the space below. When finished, press ENTER twice.

71

Is there something that you (personally) could do to improve this situation?

Type your answer in the space below. When finished, press ENTER twice.

72

In what way or ways does this concern adversely affect you, coworkers, and/or patients?

Type your answer in the space below. When finished, press ENTER twice.

73

Do you have any other comments or suggestions you would like to make regarding this WORKPLACE CONCERN?

If you do not wish to make any additional comments, simply press ENTER twice.

DEMOGRAPHIC SECTION

74

The following questions ask for some demographic information about you. This information is for statistical purposes only. It will not be used to identify you. This information is only being gathered so that the data can be grouped in various ways when statistical analyses are done (e.g., by sex, educational level, etc.).

However, you can decline to answer any single demographic question (e.g., your sex) by choosing the "decline to answer" option presented after the question.

Press any key to continue.

75

If you are sure that you do not want to answer any of the demographic questions, you can skip this set of questions completely.

Type 1 to skip all of the demographic questions.
Type 2 if you are willing to consider answering some of the demographic questions.

76

What is your sex?

1. Male
2. Female
3. I decline to answer.

Press 1, 2 or 3.

77

What is your highest level of education?

1. Did not graduate from high school
2. High school graduate
3. Some college, no degree
4. Associate's degree
5. Bachelor's degree
6. Advanced degree (beyond bachelor's)
7. I decline to answer.

Press a number between 1 and 7.

78

What is your position?

1. Staff physician
2. Fellow
3. Resident
4. Intern
5. Nurse
6. Paramedic
7. Corpsman
8. Other
9. I decline to answer.

Press a number between 1 and 9.

79

How long have your worked for this organization?

1. Less than 6 months
2. Between 6 months and 18 months
3. Between 18 months and 3 years
4. Between 3 and 5 years
5. More than 5 years
6. I decline to answer

Press a number between 1 and 6.

80

You have completed the survey! Thank you very much for your help.

81

Do you have any comments about this SURVEY SYSTEM? If so, type them in the space below. Press ENTER twice when you are done.

If you do not wish to make any additional comments, simply press ENTER twice.

82

THANK YOU VERY MUCH FOR PARTICIPATING!

To exit, wait until this screen is replaced by the Welcome screen and press Ctrl-End.

REPORT DOCUMENTATION PAGE

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13. ABSTRACT *(Maximum 200 words)*

Iatrogenic illness and injury are a major source of morbidity and mortality for hospitalized patients. However, little is known about the incidence, nature, and causes of adverse medical events. The objective of this project was to develop a survey that could be used to assess adverse medical events. The survey was designed to obtain systematic information about adverse medical events. The critical incident technique was used to develop the Computerized Critical Incident (CCIT) survey. A test version of the survey (CCIT-1) was installed in the Intensive Care Unit of a major military hospital; 482 incident reports were collected. The survey system was positively received by the staff and the reports resulted in a number of corrective actions. The survey was revised to correct several problems. The second version of the survey (CCIT-II) was evaluated by subject matter experts. The feedback provided by the subject matter experts were used as the basis for a second revision. This resulted in the third, current version of the survey (CCIT-III).

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